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Can Mobile-Linked Bank Accounts Bolster Savings? Evidence from a Randomized Controlled Trial in Sri Lanka

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ABSTRACT

In developing economies, mobile-linked services have the potential to significantly reduce transaction costs and provide a truly new conduit that could be used to facilitate the flow of savings into banks. We test this premise by introducing a product that permits Sri Lankan households to deposit mobile airtime balances into a formal bank using a new mobile money interface. Using high frequency panel survey data and randomizing access and prices at the individual level, we find that there are moderate percentage increases in savings deposits with the partner institution and formal banks more generally, but no change in overall savings deposits. When the transaction costs are completely removed, only 26 percent of those offered the service use it, and 7 percent use it frequently. Overall, our results imply that transaction costs may not be a significant barrier to increasing deposits, limiting the potential gains of mobile-linked savings products for financial inclusion.

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1 Introduction

A majority of the world's poor are unbanked. This is troubling given well-identified studies showing that increased access to formal savings causes surprisingly large impacts on business investment (Dupas and Robinson, 2013), health and education (Prina, 2015), income (Schaner, 2016), and labor supply (Callen et al., 2014). But Dupas et al. (forthcoming) provide evidence from large samples in three countries that simply reducing the fixed cost of opening a bank account is not sufficient to generate widespread usage of the accounts. One explanation is that transactions costs of using the accounts remain high even when the fees charged to open the accounts are eliminated. This is particularly true for potential users who may live some distance from the nearest bank branch. Given the small size of typical deposits of the working poor, the time and pecuniary costs of traveling to the bank may make regular use of formal savings accounts impractical.

We report here on a field experiment in Sri Lanka that aimed to reduce the ongoing banking transactions costs by allowing participants to make deposits into regular bank savings accounts through their mobile phone. The intervention allowed participants to make deposits through any mobile phone agent. Because there are many more mobile agents than bank branches, mobile-linked accounts have the potential to reduce the ongoing transactions costs. For this reason, there is a belief that mobile technology can increase saving rates and provide significant welfare benefits. The promise of mobile-linked services has led to significant resources and political will devoted to facilitating its spread.[1] Despite the push to link mobile money to conventional interest-bearing bank accounts (Goss et al., 2011), progress in building these products has been slow (Suri, 2017). Penetration in most countries remains low, with less than one in four households globally using any mobile money service.[2] Moreover, mobile money systems are rarely integrated with formal banks (or even integrated across telecom companies), limiting options for true mobile banking services (Suri, 2017). This slow growth raises questions of whether mobile-linked saving products will have significant demand and will increase savings mobilization, and whether the willingness to pay for these services can support their development and sustainability.

Participants in our experiment were randomly assigned to a control group or one of four treatment groups that differed in the fees charged to make a deposit. By varying the fees from 8 percent of the deposit – slightly more than the partner's estimated cost – to zero, we are able to provide evidence on the willingness to pay for banking services, and to estimate the related elasticity of demand. Because our largest treatment group paid no fee to use the service, we are also able to measure the increase in demand for formal savings accounts when deposit-related transactions costs are reduced nearly to zero.[3] As such, our study complements Dupas

[1] For example, the Bill and Melinda Gates Foundation's strategy for financial inclusion focuses on broadening "the reach of low cost digital financial services" and India's 2016 demonitization is often justified as a push to transition to a digital economy.

[2] In addition, not all countries that have invested in building digital economies have been successful. As evidenced as perhaps one of the strongest pushes towards digital finance, a year after the 2016 demonetization in India, digital transactions have dropped below its peak and are growing at slower rates each month (Chakrovorti, 2017).

[3] To further reduce the effective transaction costs, our intervention included measures to eliminate other potential barriers to savings deposits as well: 1) assistance with opening the partner bank account, including payment of the $4.55 minimum balance requirement, 2) a mobile phone and SIM card, and 3) personalized demonstrations on using the service, including two transfers of $.45 into one's own account.

et al. (forthcoming) in reducing the ongoing transactions costs associated with using a bank account. Using high-frequency household income and expenditure surveys, we examine the effect of accounts on overall household savings, consumption, and labor earnings.

We have three main findings. First, use of the service was relatively low, even for those assigned to the group able to use the service for free. While 80 percent of participants opened the bank account and participated in demonstrations on how to make deposits, only 26 percent made at least one deposit through the mobile service, and only 7 percent made 10 or more deposits. Though we find some heterogeneity in usage in expected directions - women and those living at intermediate distances from bank branches were more frequent users - the usage levels remain low in all subgroups.[4] The modest adoption rates are in line with those found in several other studies introducing innovations designed to reduce transaction costs (e.g. Dupas et al., forthcoming; Flory, 2011; Ashraf, Karlan and Yin, 2006).

Second, we find that the mobile-linked deposit service caused a 44 percent increase in savings deposits in the partner bank and a 29 percent increase in savings in the formal banking sector more generally. However, there was no increase in total household savings. Moreover, these percentage gains are relative to a very small control-group mean, and hence do not correspond to meaningful increases in the average amount deposited into formal savings, even with the partner bank. Not surprisingly then, we see no change in household welfare measures, such as household consumption or labor supply. Furthermore, a significant proportion of the gain in bank savings we observe comes from the traditional channel of depositing savings in person at the bank, suggesting that once the account was opened, those interested in using it were willing to incur the in-person transaction costs even when the mobile-deposit service was free to use.

Third, we find a general lack of responsiveness to the (randomly assigned) price levied for the service: the amount deposited through the mobile channel does not decrease consistently as the fee increases. Only at the 8 percent fee do we observed reduced usage of the mobile deposit service. But even then, our data suggest that the fee simply shifted the transactions from the mobile channel to the in-person channel, with no overall difference in deposits made in the partner bank.

Taken together, these three findings suggest that transaction costs for saving deposits are unlikely to be a significant inhibitor for saving rates. Our modest impacts from providing an ever-present, private, and free mobile deposit service can be seen as bounding the transactions cost improvements from this mobile savings technology relative to the next-best channel. The experiment provides one of the first estimates of the effect of mobile-deposit services on savings, contributing to growing literatures on the uses of mobile money and on the importance of transaction costs for savings mobilization. With the strong push for financial inclusion built on the premise of reducing market imperfections in formal financial markets, understanding the impact of digital finance is particularly important. Our analysis is based on a large individual-level randomized controlled trial with high-frequency panel data on savings for over two years. The significant sample size and

[4]Women theoretically have greater concern for other-control (Ashraf, 2009), more restricted mobility, and smaller average deposits, all features potentially addressed by the technology. Those living at intermediate distances would arguably most value reduction in transaction costs for deposits, but not be deterred by less frequent withdrawal costs.

length of study, near-perfect compliance with the randomization, and low attrition all bolster the internal validity of our causal interpretation. In addition, our measures not only capture savings with the partner institution, but also estimate impact on total savings and formal savings, which have implications on financial intermediation and economic growth.

The Sri Lankan setting is a particularly good one for estimating the effect and price elasticity for mobile-linked financial savings. First, Sri Lanka is typical of most low- and lower-middle income countries in that mobile phones are ubiquitous but electronic financial services (e.g., ATMs) are more limited. Mobile money was absent at the time of the intervention and continues to have very low penetration. While Sri Lanka has relatively high rates of formal bank account ownership, a large proportion of savings continues to be held in informal saving devices (The World Bank, 2013). Second, there is high trust in the banking system in Sri Lanka, helping to overcome market imperfections related to informational asymmetry and institutional uncertainty that may dampen the marginal benefit of reducing transaction costs in other contexts. And finally, previous research in Sri Lanka identified significant latent demand for formal banking services and provided compelling reasons to suspect transaction costs were an important market imperfection resulting in undersaving: Callen et al. (2014) find that a weekly deposit collection service increased total savings by over 15%.[5]

Our results are consistent with the growing literature on mobile-linked savings, and more broadly, on the impact of reducing transaction costs for savings deposits to improve savings. The handful of studies examining mobile-linked savings generally find results consistent with ours, despite being in settings where mobile money is more popular. Both Batista and Vicente (2017) and Bastian et al. (2018) measure the marginal effect of connecting formal saving options to mobile platforms in contexts of existing mobile money users. In both cases, they observe savings being directed to the savings product, but also reductions in alternate saving devices, leading to no significant increase in total savings. Studies focusing on reducing transaction costs for a mobile-money-based saving device that is absent many of the features of formal savings find similarly modest results. Batista and Vincente (2016) conduct a field experiment introducing mobile money alone in Mozambique. Consistent with earlier findings of Jack and Suri (2014) in Kenya, they find that mobile money increased consumption smoothing through remittances, but not through increased savings.[6]

Batista and Vicente (2017) and Bastian et al. (2018) identify the marginal demand for formal banking features, relative to existing mobile money, in the absence of transaction costs for depositing savings. The mirroring studies by Batista and Vincente (2016) and Jack and Suri (2014) identify the effect of eliminating transaction costs for a saving device that is absent many of the features of formal savings. We add to the literature by estimating an intervention that combines these two components. This is key to understanding the impact of transaction costs in facilitating formal savings, a particularly relevant issue given the focus

[5]Our results are robust to limiting our sample to be similar to the sample selection process used in this earlier work.

[6]In Jack and Suri (2016)'s follow up work, they do find that savings was higher in places with mobile money, but are unable to identify whether this is a direct effect of mobile money or an indirect downstream effect from intermediary outcomes (e.g., reduced vulnerability to shocks may also yield increased savings in the long run).

financial inclusion initiatives place on "banking" individuals due to concerns that informal savings are higher risk, higher cost, and less convenient. The marginal effects identified in previous studies identify each component separately and therefore provide lower bounds to an intervention like ours which estimates a combined effect that captures potential complementarities. Our results are consistent with their modest impacts and suggests that the marginal gain from the interaction is low.

More broadly, our results contribute to the role of deposit transaction costs as barriers to efficient savings mobilization. Studies eliminating the pecuniary costs of opening bank accounts have found mixed results, with the largest and most representative (Dupas et al., forthcoming) finding modest effects (Dupas et al., 2012; Dupas and Robinson, 2013; Prina, 2015; Cole, Sampson and Zia, 2011).[7] Studies that have directly focused on reducing transaction costs for savings deposits have also generally found modest results, but have also not measured impact on total savings mobilization (Flory, 2011; Ashraf, Karlan and Yin, 2006) An exception is Callen et al. (2014) who introduce a weekly deposit collection service in Sri Lanka and do find significant gains in total savings. The heterogeneity in this literature may be due to intervention features addressing additional constraints or confounding contextual constraints. For example, some of these interventions also introduce features that address commitment concerns or are implemented in contexts where the benefit of decrased transaction costs is reduced (e.g., respondents in Dupas et al. (2012) list risk of embezzlement and high withdrawal costs as explanations for their lack of demand). Our results support what we see as the growing consensus in this literature that deposit transaction costs determine where a person saves, but are unlikely to be a primary barrier responsible for inefficiently low savings.

The remainder of the paper is organized as follows: Section 2 presents the study context and design, Section 3 analyzes the impact of the product at the individual level, Section 4 presents demand and implications on targeting for the mobile-linked savings product, and Section 5 concludes.

2 Study Context and Details

2.1 Product Description

In 2009, we began working with a large mobile operator and a small software company in Sri Lanka to develop a savings product that would allow deposits to be made directly through a mobile phone to a savings account in a large, government-owned bank (referred to as the partner bank). Customers could purchase mobile phone top-up scratch cards to deposit funds into the bank account using a procedure similar to that used for adding minutes to their mobile phone.[8] The product allowed the user to dial a number, enter the scratch card serial

[7] Dupas et al. (2012) found low demand for bank accounts in Kenya even after waiving account fees. But Cole, Sampson and Zia (2011) found that subsidized accounts in Indonesia led to greater opening and use of the account; Prina (2015) similarly finds high demand for subsidized accounts in Nepal with little support for increases in downstream effects; and Dupas and Robinson (2013) found significant effects on business investment and expenditure from free accounts, but for only a subset of their sample.

[8] 77 percent of our sample lived within 200 meters of a merchant selling scratch cards and 58 percent of our sample added minutes to their phone at least once a week. In contrast, our sample's average time to make a deposit at a bank is 21 minutes and only 23 percent had made a bank deposit in the previous month at baseline.

number, and deposit the amount on the card into an m-purse account linked to the phone. The m-purse account was linked to a savings account, and by entering a PIN, the user could move the money from the m-purse to the savings account. The scratch cards were available in multiple denominations, from 50 LKR to 1,000 LKR (.45 USD to 9.09 USD).[9] In our baseline survey, 72 percent of our primary sample (described in the following section) reported that their typical deposit into any formal saving devices was 1,000 LKR or less, suggesting that the scratch card denominations available would not have been unduly burdensome.[10] This was the first product of this type offered in Sri Lanka.

While the use of scratch cards for loading airtime on phones is becoming less common, the time and effort costs of scratch cards are not materially different from newer methods, which continue to require interacting with a local agent. And at the time of this study, scratch cards were still very common. The scratching of the card itself is a very small component of the transaction time. In addition, in places that currently have connectivity between mobile money and linked saving accounts, a PIN is a common method for transferring mobile money into an account. Finally, at the time of the experiment, the majority of our sample were adding minutes to their mobile phone at least once a week, suggesting that the marginal time and effort costs were small.

The mobile operator with whom we partnered agreed not to market the product in the region where we were conducting the research during the term of the project, ensuring perfect compliance with the randomized controlled trial. This unusual degree of control over access to the product is a major advantage for estimating causal effects relative to other studies of mobile banking products.

On the other hand, the product was launched without advertising and other support typical of new product offerings. We took a series of steps to overcome the lack of advertisement, stimulate use of the product, and overcome potential barriers to realizing the service's benefits. These are thus bundled components of the intervention. First, we worked with the mobile operator to inform and train customer service representatives so that someone knowledgeable of the product was always available at the service call center. Second, we offered participants a free basic phone and SIM card. Third, we helped them open the savings account linked to the phone, including providing the 500 LKR (4.55 USD) minimum balance required to open a savings account at the bank.[11] Forth, we arranged a demonstration of how to use the product, which included making two deposits of 50 LKR (0.45 USD) each into the individual's account. And finally, for two months in each municipality, we encouraged use of the service by conducting a lottery among users of the service.[12] These incentives were provided to all treated individuals and are intended to eliminate constraints to account usage

[9]The median exchange rate in 2011 was 110 LKR to the US dollar.

[10]The PIN offers protection for the account in the event the phone is lost or stolen. It also means that other members of the household could use the phone for calls without having access to the account, a feature which may be important in some households.

[11]The bank account provided 4 percent interest annually which is comparable to saving accounts at banks in general at this time.

[12]Each deposit into the account generated one chance of winning a deposit of 5,000 LKR (45.5 USD) for the account holder. This incentive was offered in one municipality, Kandy, in August and September 2012, and the remaining municipalities in April and May 2013. Our primary results are robust to excluding these months in our analysis. In the former, we observe a statistically significant increase in the use of the service (.5 more transactions, significant at the 5 percent level). In the latter, we observe a statistically insignificant increase of .04 transactions.

arising from other pecuniary costs (e.g., bank fees), material costs (e.g., phone costs), or lack of experience using the service. We are unable to isolate the importance of each component of the treatment bundle, but given the modest results we estimate, we do not see this as a major drawback.

2.2 Distribution Timeline

The introduction of the product to study subjects, initiated by the sending of the offer letter, was subject to several delays. This means that we have more baseline survey rounds than anticipated, but in all cases the accounts were available to be opened and the mobile conduit was functional when the product was first offered to an individual. The first offer letters were delivered in December 2011, one year after our baseline survey, providing us with an year of savings data prior to households being aware of the intervention. Demonstrations began by February 2012 in one municipality, by April 2012 in four more municipalities, and by September 2012 in the remaining municipality. By September 2012, 86% had accepted the offer (i.e., opened an account and received the phone and SIM card). Figure 1 provides a summary of the timeline for the roll out of the mobile-deposit service intervention and the data collection.

2.3 Sample Selection and Randomization

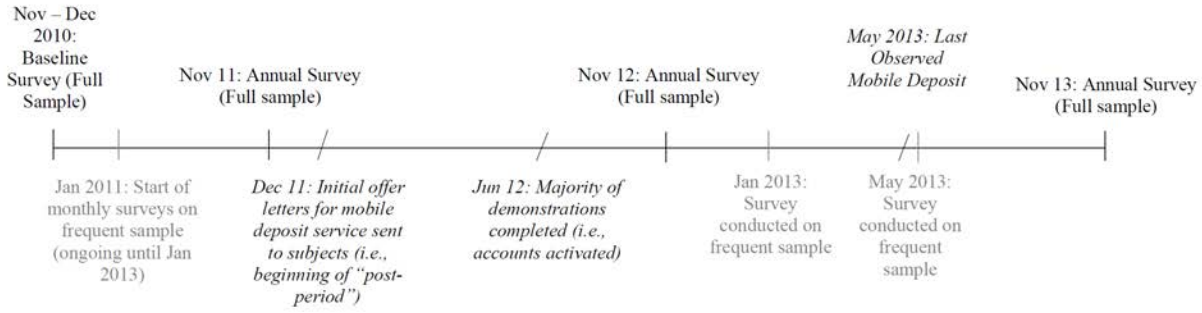
To select the sample for the study, we conducted a listing exercise in August 2010 in six municipalities[13] in central Sri Lanka. The household listing identified 13,435 economically active adults from 10,300 households. This initial listing was stratified by distance to the nearest town (i.e., to a bank branch): urban (under 2km), semi-urban (2km to 5km), and rural (over 5km).[14] We then narrowed this sample based on characteristics predicted to have high demand for the mobile-deposit service: households with members paid on a daily or weekly basis (and therefore having higher value for frequent deposits) and stated willingness to have an interest-bearing savings account. Imposing these restrictions narrowed the potential sample to 3,102 individuals (2,372 households), from which we selected 2,006 individuals from unique households as our final sample. This final selection oversampled individuals with characteristics that would arguably have a greater likelihood of adopting the savings service (those who lived within .5 km of the nearest mobile phone agent, who used their phones to send SMS messages regularly, who had previously changed a SIM card, and who were under 50 years of age) or were of particular interest (female). However, given that we select an individual from 85 percent of the households (2,006 out of 2,372), these oversampling criteria mostly determined which individual in the household (rather than which households) we selected.

The mobile-deposit service (along with the bundled activities described in the previous section) was randomly offered to 1,625 individuals from the baseline sample of 2,006 individuals. Within this treatment group, individuals were randomly assigned a fee to be deducted from each deposit made through the mobile

[13] Kandy (KN), Katugastota (KT), Pelimathalawa (PL), Matale (MT), Kurunegala (KR), and Kegalle (KG).

[14] A primary purpose in including those over 5km away was to compare the intervention's results with those found in Callen et al. (2014), in which a weekly deposit collector significantly increased savings.

Figure 1: Study Timeline (Not drawn to scale)



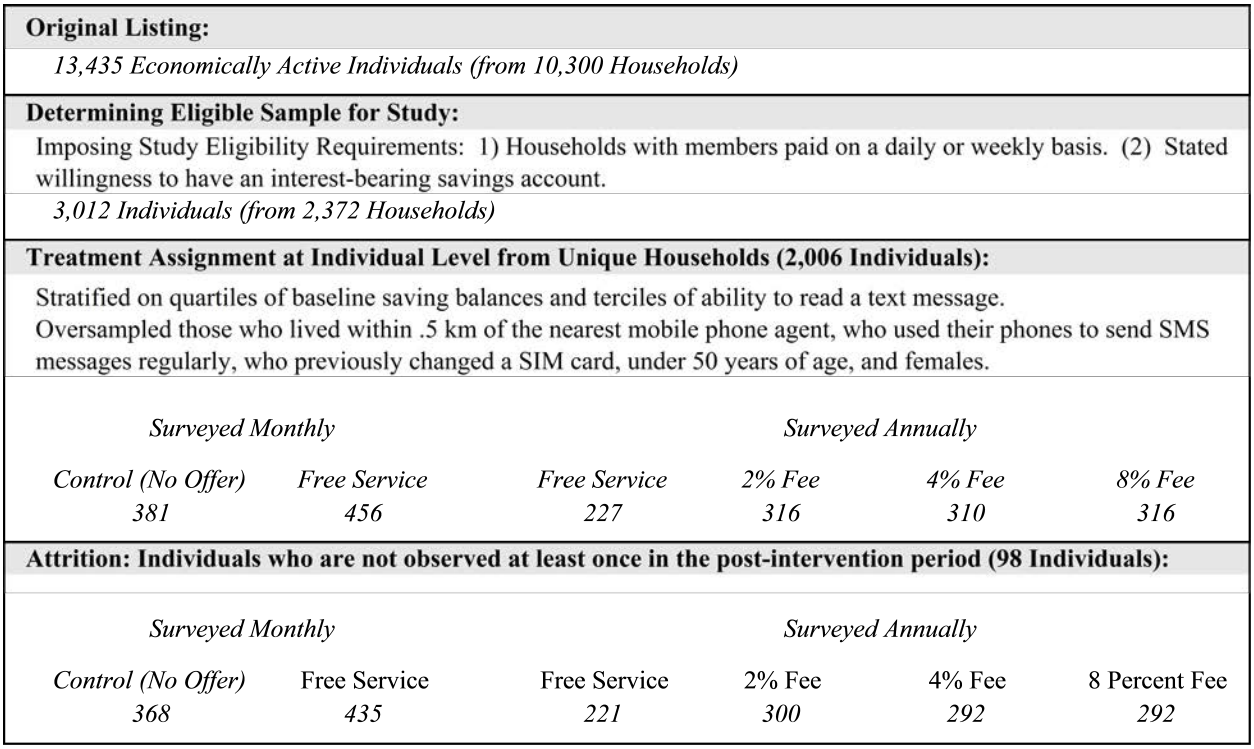
channel: free (683 individuals), 2% fee (316 individuals), 4% fee (310 individuals), and 8% fee (316 individuals). Those in the free service were further randomized to be surveyed annually (227 individuals) or monthly (435 individuals), as described in further detail in the following section. The control sample received no offer nor the promotional activities surrounding the offer, but were surveyed monthly. The treatment randomization was stratified on quartiles of baseline saving balances and terciles of a test score based on the ability to read a text message. Figure 2 provides an overview of the sample selection.

2.4 Data

We conducted an initial baseline survey in November and December 2010 (see Figure 1). From 2011 to 2013, three detailed annual surveys were conducted each November. To improve the precision of our estimates, we surveyed the control sample and 456 randomly selected individuals from the free mobile-deposit service treatment arm every month from January 2011 to December 2012 and in January and May of 2013 (i.e., 25 waves of the survey). We refer to this as the monthly surveyed sample. This high-frequency panel has the advantage of increasing statistical power for detecting the causal effect of the free mobile-deposit service offer. Due to the unforeseen delay on rolling out the service, our baseline data covers more than a year of monthly surveys and two annual surveys. These surveys provide rich detail on savings behavior prior to the intervention, with detailed information on individual savings deposits using a monthly recall period.

We also observe deposits made through the mobile-deposit service from the start of the intervention until May 2013. We are unable to observe account balances and withdrawals using institutional data from the bank, and so rely on survey data for impacts on savings behavior. Given our design, the core analysis focuses on the comparison of the free treatment to the control using the monthly surveyed sample, and the estimation of price elasticities uses the annually surveyed sample within which the service fee was randomized.

Figure 2: Sample Selection



2.5 Validity: Attrition and Balance

Given the length of time between the initial baseline survey and the roll-out of the intervention, there is some attrition in the sample. Since participants were unaware of their treatment status until they received an offer letter in December 2011, we take this attrition as random with respect to treatment. We define a Panel Sample of individuals surveyed at least once after the mobile-deposit service offer letters were delivered, and use this sample for our analysis. Online Appendix Table A.2 tests for differential attrition into the Panel Sample and differential response rates to the multiple surveys by treatment status. We find attrition is low and balanced across treatment status among those surveyed monthly (including among sub-groups of interest for heterogeneity). Though we do find some statistically significant differences in attrition across treatment arms in the annual sample, for all prices except the 8 percent fee, there is no differential response rate in the period after the mobile-deposit service is offered relative to the months before. The remainder of the paper limits observations to the Panel Sample to be consistent with the sample used in the key estimations of the impact of the mobile-deposit service.

The Panel Sample is balanced on baseline characteristics (Online Appendix Table A.1) and on savings outcomes of interest[15] as measured in the monthly surveys prior to the intervention roll-out (Online Appendix

[15]The survey questions are as follows: "After deducting the total amount of money given to others from the total amount of money received, you had Rs _____ remaining for saving or spending in the past month of _____. Can you tell me how much money you saved using the following methods – Saving in an institution such as a bank? Total?" Beginning in September 2012, the first question was replaced with the following two: "Money saved in [the partner bank] ? Money saved in bank accounts in

Table A.3). We confirm balance for both: 1) the monthly sample (used to estimate the causal effect of the mobile-deposit service), comparing those who received the mobile-deposit service for free with those in the control group; and 2) the annual sample (used to estimate the price elasticity for the mobile-deposit service), comparing those randomly assigned to different mobile transaction fees.

2.6 Sample Characteristics: Banking and Mobile Phones

Our sample selection is stratified on distance to the nearest town, a proxy for banking services: forty-four percent live within two kilometers of a bank, another forty percent live 2 and 5 kilometers from a bank, and the remaining 16 percent lived more than 5 km away. The average travel time to the closest bank is 16 minutes (21 minutes for a deposit) and travel costs are 9 LKR (.08 USD). In contrast, 72 percent of our sample is able to top up their phone within 200 km. There is a negative correlation between the time it takes to go to the bank and both formal and total savings deposits. There is no correlation between savings and the cost of going to the bank. Though 88 percent of the sample has a bank account and 62 percent report having "a great deal" of trust in banks and financial institutions, only 19 percent of the sample have visited an ATM to withdraw funds in the previous year, suggesting lower usage of electronic banking services. A significant proportion of our sample are not actively using formal bank accounts, despite having an account in their name: only 12 percent report using a formal savings account more frequently than once a month. During this baseline period, average monthly formal savings deposited were 1,533 LKR (14.04 USD), whereas average monthly total savings deposits were 5,989 LKR (54.84 USD). Among those who made any saving deposits in a given month, only 11 percent of savings was deposited into a formal account. Note that these average amounts hide a very skewed distribution – in fact, over 75 percent of subjects in a given month reporting no formal deposits and the median monthly total deposits is 2,075 LKR (19.00 USD). At baseline, 69 percent report having a balance of less than 10,000 LKR (92 USD) in their formal account, just 42 percent of their reported mean monthly household consumption.[16] Given our sampling rules, we observe a high penetration of mobile phones (89 percent), though capacity to use various functions on a mobile phone is more limited. See Online Appendix Table A.1 for additional descriptive summary statistics.

Our sample reflects the Sri Lankan context: despite significant penetration of formal bank accounts, informal savings methods remain common and frequent usage of formal banks for saving deposits is low. In general, 83 percent of Sri Lankans have a bank account, but only 31 percent save at a financial institution and only 45 percent report "[having personally] saved or set aside money for any reason" in the previous year. The low use of financial institutions suggests unmet demand for formal bank accounts, despite the high penetration of owning bank accounts.

your name at banks other than [the partner bank]?". We use the inverse hyperbolic sine transformation of savings amounts to account for the skewed non-normal distribution of savings deposits (Burbidge, Magee and Robb, 1988). The same balance test using outcomes without the inverse hyperbolic sine transformations confirms the validity of the research design (not shown).

[16] See Appendix for more details on variable definitions and balance tests.

Table 1: Mobile Deposit Service Adoption by Fees Charged

	(1) 0%	(2) 2%	(3) 4%	(4) 8%
Letter Delivered	0.979	0.990	0.990	0.969
Account Accepted	0.910	0.903	0.921	0.873
Demonstration completed	0.800	0.733**	0.760	0.702***
Used service	0.258	0.203*	0.226	0.178***
Observations	656	300	292	292

Letter Delivered and Account Accepted are based on enumerator reports. Demonstration completed and Used service are based on institutional data provided by the partner bank. The 0% sample combines those surveyed annually and monthly. Statistical significance is based on regressions which include variables upon which the random assignment were stratified and uses robust standard errors. Observations are limited to individuals in the panel sample. Comparisons to the free mobile service offer are indicated by * p<0.1, ** p<0.05, *** p<0.01.

2.7 Implementation of the mobile-deposit service

The adoption of the mobile-deposit service proceeded in several steps. First, treated participants were offered the service at the randomly designated price by letter (Letter Delivered). The participant then decided whether or not to accept the offer by coming to the partner bank branch during a designated time window to open and account and receive the phone and SIM card (Account Accepted). Finally conditional on opening the account, the project team arranged a demonstration at the participant's house in which 100 LKR (.91 USD) was deposited in the account using the mobile-deposit service (Demonstration Completed). Table 1 provides summary statistics on take-up for each stage of this process. Because these events happen in succession, a later stage can only occur if the previous stage was completed. All treated participants could make deposits on their own into their account.

Subjects were unaware of the product until the first offer letters were sent in December 2011, a year after the initial baseline survey. We were able to reach 98 percent of the Panel Sample to make the initial offer (Row 1). Among those provided the service for free, 91 percent accepted the offer and 80 percent completed the demonstration. The service itself is used at least once by 26 percent of those who received the mobile-deposit service for free (Used service); 7 percent made 10 or more mobile deposits. Though this usage rate is low, it is similar to take up rates of savings products in several other studies (e.g. Dupas et al., forthcoming; Flory, 2011; Ashraf, Karlan and Yin, 2006).[17]

In May 2012, about three months after the the product was first launched, we asked a series of questions on our monthly survey to better understand adoption and usage patterns of the service. We asked the treated sample for their own assessment of their ability to use the service. Of the 186 respondents who had received the demonstration by the time of the survey, 45 percent said they had high confidence and 39 percent said

[17] 99 percent recalled received a demonstration in subsequent surveys, allowing us to rule out lack of awareness of the service as a potential explanation for low demand.

they had somewhat high confidence in their ability to use the service. However, 41 percent agreed at least "to some extent" that the mobile bank saving service was complicated/difficult, and 20 percent said they disliked the service due to technical problems. These responses suggest that despite the high levels of self-reported confidence, learning how to use the service still imposed a cognitive cost. When asked why they hadn't used the service more, the two leading responses were that the respondent did not have enough money (36 percent), and that technical concerns that arose when depositing (31 percent); 25 percent said at least "to some extent" they preferred to deposit directly at the bank rather than using the mobile channel. No respondent voiced a lack of trust in the banking system or mobile phone companies as an explanation for lack of use. When asked what they liked about the service, the most common response, by far, were the "ability to save at any time of day" and the "ability to save even a small amount." This suggests that individuals were well aware and understood the direct benefits of a mobile-deposit service. Overall, our survey responses suggest that individuals understood well that the service reduced transaction costs for saving deposits, but that this benefit may not have been appealing enough to overcome learning costs, despite the fact that the service closely mimicked a well-known process.

3 The Savings Effects of a Mobile-Deposit Service

3.1 Primary Estimating Equations

Our primary question of interest is whether the intervention resulted in increased total savings, a reallocation towards formal savings, or at a minimum, a diversion into the partner institution. We estimate the standard experimental intention to treat using the random assignment to treatment with the following linear regression specification:

$$SavingsDeposits_{si} = \beta_0 + \beta_1 MobileOfferFree_{si} + \mu_s + \epsilon_{si} \quad (1)$$

where *SavingsDeposits* are the monthly mean of the following: the amount of total savings deposits at the partner bank, an indicator for making a formal saving deposit, the amount of formal savings deposits, an indicator for making any saving deposit, and the amount of total savings deposits. These dependent variables have a monthly recall and are the mean responses over all surveys conducted in months after the baseline period (i.e., December 2011 onward). *MobileOfferFree* is an indicator for whether the individual was assigned to the free mobile-deposit service offer, and μ_s reflect fixed effects for the the variables upon which the randomization was stratified; s represents the strata used in the randomization and i represents individual. For the impact estimation we limit the estimation to the monthly survey sample, meaning that individuals are either in the control arm or in the free treatment arm.

Additionally, we estimate a difference-in-difference model by expanding our estimating equation to include

individual fixed effects, α, and include the one year of data prior to the initial offer letters:

$$SavingsDeposits_{sit} = \beta_1 MobileOfferFree * Post_{sit} + w_t + \alpha_i + \epsilon_{sit} \quad (2)$$

where *Post* is an indicator for the month of and after December 2011, after the initial letters introducing the mobile deposit service were delivered; w reflects fixed effects for each survey wave; t reflects the monthly recall period of the survey. Table A.3 confirms the identifying assumption of savings deposits being statistically similar across treatment status prior to the offer letters being sent. We use probability weights to ensure that each individual is given equal weight in our estimates regardless of differential response rates by individuals to a given survey wave.[18] In earlier survey waves, savings recall with respect the partner bank was not specifically asked, and so partner bank savings is excluded in the individual fixed-effects specification. Eq (2) is our preferred estimating model due to the increased precision from controlling for average individual behavior, but we include Eq (1) primarily to estimate effects on savings with the partner institution, which we do not observe in initial post-treatment months.

The core impact analysis focuses on the free mobile-deposit service for the following two reasons. First, the free service offers an estimate that is not confounded by financial frictions levied on the consumer, and therefore provides an upper bound of the effect of a mobile-deposit service. Secondly, the control sample was interviewed monthly whereas the fee-treatment samples were interviewed annually. Because being surveyed at different frequencies may differentially affect responses, we focus our comparison on the control sample and the (randomly selected) subset of the free mobile-service deposit that were also surveyed monthly. Finally, the increased survey frequency provides a high-powered estimate of a frictionless mobile-deposit service offer.[19] Section 3.4 then uses the annual survey sample to estimate price elasticities

3.2 Variable Transformations and Robustness Statistics

Given that savings deposits follow a highly skewed non-normal distribution, we follow the recent financial services impact literature in analyzing our primary outcomes of interest using the inverse hyperbolic sine transformation (Burbidge, Magee and Robb, 1988). This transformation retains the interpretation of a log (i.e., impacts are in percent changes) but can handle zero values. Because absolute savings deposits are still the relevant measure for bank profits and purchasing power, we also report effects on non-transformed total amounts in the text of the paper (with the complete tables presented in the Appendix).

To overcome this sensitivity to scale, we augment our results by testing whether the control's distribution of savings is significantly different from those offered the mobile-deposit service. Using average monthly savings per individual[20], we estimate the Kolmorogov-Smirnov (KS) statistic, testing whether the distri-

[18] Results from Eq(2) are robust to excluding these probability weights.

[19] Results from Eq(1) and Eq (2) are relatively robust to including subjects surveyed annually and comparing those who received the free service to the control, and comparing those who received the service at any fee to the control. When we include those surveyed annually, we observe slightly higher percent increases in deposits to the partner bank and formal banking more generally, but continue to find no support for increased total savings deposits.

[20] To abstract away from the issue of frequency versus total amount of savings deposited, both of which may be affected by

butions of changes in average monthly savings are significantly different as a function of treatment status. Changes in savings deposited is measured by calculating an individual's average monthly savings during the pre-period and post-period and taking the difference between the two, akin to our individual fixed-effects difference-in-difference approach in the regression framework (i.e., Eq 2). Because savings deposits with the partner bank were not measured in the pre-period, we are unable to measure changes and instead use the average monthly savings deposited with the partner bank in the post-period for the months in which this question was asked. The benefit of the KS statistic is it is non-parametric, insensitive to scale, and robust to non-normal distributions.

In addition to the KS statistic, we illustrate the impact on saving deposits across the distribution by plotting the cumulative distribution function by treatment status of average monthly deposits with the partner bank and the change in average monthly formal and total deposits.[21] This provides a more transparent and graphical representation of how saving deposits are changing along the distribution.

Given the relatively low uptake, large number of zero deposits, and large variance in savings deposits, we do not expect that the distribution of changes in savings deposits in the treated group to first-order dominate the distribution of those in the control group. Instead, we test whether the probability of observing a higher amount of savings with the partner bank or a more positive change in formal and total average monthly savings deposits for those offered the service is greater than one would expect by chance.[22] We estimate this probability from random draws of our sample: we randomly draw an observation from the control sample and the treatment sample and compare which of the two experienced the higher gain in their average formal and total monthly savings deposits from baseline period to the post-period; for the partner bank deposits, we observe which is higher in the post-period. We repeat this 1,000 times, with replacement, to estimate the probability of observing a larger change in savings among the treatment relative to the control (*Savings Probability, SP, Statistic*). We then bootstrap standard errors for the SP statistic by arbitrarily reassigning treatment status to our entire monthly surveyed sample and estimating the SP statistic for this arbitrary treatment assignment – we repeat the procedure for 1,000 different samples where treatment is arbitrarily reassigned. We then compare the SP statistic given the true treatment assignment to the distribution of simulated SP statistics, providing us with the likelihood, or p-value, of observing our SP statistic by chance.

The KS statistic, CDF, and SP statistic are all methods that are scale-invariant and identify distributional shifts that may not be detected when simply comparing means.

the mobile deposit service, we calculate mean monthly savings per individual when comparing distributions. For example, if the mobile-deposit service offer led to no difference in total savings but deposits became small and more frequent, then this would result in the CDF being dominated by the control sample at higher amounts when using individual-month observations, even though the offer had not reduced the total amount of savings deposited.

[21] Specifically, an individual's monthly saving deposit is transformed using the inverse hyperbolic sine transformation. We then calculate the average in the months prior to the intervention and the average for after the start of the intervention, and take the difference of the two.

[22] This test is analogous to the Mann-Whitney test (Mann and Whitney, 1947). The only difference is that instead of testing whether the probability of a random draw from the treated distribution is greater than the control is higher than 50 percent, we test whether the probability is higher than would be under chance. We do this to account for the large number of "ties" in the two distributions because of the many zeros.

3.3 Estimated Impacts on Savings

Table 2 provides the intent-to-treat estimates on the causal effect of the free mobile-deposit service offer estimated by Eq (1), Panel A, and Eq (2), Panel B. We observe a significant increase in monthly savings deposits with the partner bank (44 percent) and formal banks more generally (13 to 29 percent). However, we find no support for an increase in total saving flows, suggesting that these results are either driven by substitution from other savings sources or the percentage gains were not meaningful with respect to total savings.

Despite the large percentage increase in savings with the partner bank, only a portion is being deposited through the mobile-deposit channel. For those who received the service for free[23], we observe only 16 percent of deposits are accounted for by the mobile channel, despite the intervention yielding an increase of 44 percent saved with the partner institution. This suggests that the mobile channel is accounting for approximately half of the observed diversion to the partner institution.

When using savings amounts without the inverse hyperbolic sine transformation, we observe no significant increase in average savings, even with the partner bank. The magnitude of increased savings towards the partner bank is relatively small (95 LKR/month, 0.86 USD/month), and even the direction for formal bank savings and total savings is not consistent across both estimating equations (see Appendix Table A.4). Given the percent gains in monthly deposits to the formal sector, this inconsistency in levels is suggestive that increased saving amounts are driven by small savers, likely at the extensive margin.[24]

Figure 3 graphs the CDF by treatment status of the mean in monthly saving deposits with the partner bank and change in mean monthly formal and total savings deposits. We find strong evidence of increased savings with the partner bank – Figure 2a highlights significant movement along the extensive margin into saving with the partner bank. Averaging at each percentile ranking, the CDF of the treatment sample does first order stochastically dominate the controls' savings in the partner bank. This is corroborated by both the KS statistic of .207 and the SP statistic of .369, both of which are statistically significant.

We find less robust support for an increase in formal savings - though the KS statistic is statistically significant at the 10 percent level, the SP statistic is not. Figure 3b does find that formal savings by those offered the free mobile deposit service is primarily to the right of the control. The shifted CDF supports the movement coming from the middle. We do find the expected increase in formal savings along the extensive margin and small savers, but this difference is small and easily dominated by behavior of larger savers. In contrast, we find no support for increased total savings, and the distributions lay virtually on top of one another at almost every savings amount (Figure 3c).

These results suggest that the intervention was effective in diverting savings towards the partner bank, but this did not result in a meaningful increases in total savings. Furthermore, the increase was too small to

[23]This summary statistic is based on the monthly survey panel sample in the post intervention period for the surveys in which the sample report partner savings.

[24]Due to the skewed distribution of savings and that we observe no consistent statistical increase when using saving amounts, it is difficult to speculate on the substitution of other savings devices.

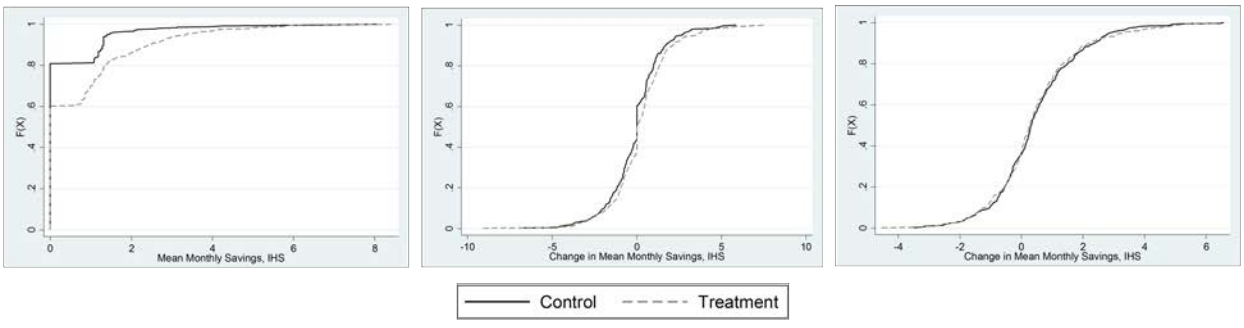
Table 2: Effect of Free Mobile Deposit Offer

	(1) Partner savings	(2) 1[Formal deposit]	(3) Formal savings	(4) 1[Any deposit]	(5) Total savings
	Panel A: Post period (December 2011 - November 2013)				
Free Mobile Deposit Offer	0.442***	0.0249*	0.131	-0.00538	-0.0249
Deposit Offer	(0.0758)	(0.0145)	(0.135)	(0.00760)	(0.0952)
Observations (Ind)	790	803	803	803	803
	Panel B: All months with individual fixed effects				
Free Mobile Deposit Offer * Post		0.0382***	0.287***	-0.00520	-0.0283
		(0.0104)	(0.0903)	(0.00811)	(0.0714)
Observations (Ind-month)		20028	20028	20028	20028
Control Mean	.33	.19	1.70	.93	8.14
KS Statistic	.207	.103	.0929	.037	.051
p-value	0.00	.026	.059	.940	.664
SP Statistic	.369	.521	.536	.42	.458
p-value	.012	.062	.202	.499	.793

Estimations are conducted on the monthly panel sample. Savings variables are analyzed using the Inverse Hyperbolic Sine, so the interpretation is as a log (percent impact). Outcomes are monthly flows over the month prior to the survey wave, and the unit of observation is individual in Panel A and individual-month in Panel B. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross sectional comparison of treatment and control outcomes using all post-treatment survey waves. Panel B uses the full set of monthly surveys, includes individual and survey wave fixed effects, and uses inverse propensity weights for attrition across survey waves to retain representativeness of the overall panel sample. The Control Mean is the mean of control individuals' means across post-treatment survey waves for the given outcome variable. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 3: All individuals frequently surveyed

(a) Left: Mean Monthly Partner Deposits; (b) Center: Change in Mean Monthly Formal Deposits; (c) Right: Change in Mean Monthly Total Deposits



increase average deposits collected by the partner bank or the formal sector in a meaningful way, suggesting limited scope for large profits or improved financial intermediation. The results do show that although the intervention did not yield significant increases in savings deposits on average, there were shifts along the distribution, particularly by small and marginal savers.

Among the control sample, the monthly formal savings usage rate (i.e., making a deposit into a formal accounts) is only 19 percent, whereas the total monthly savings usage rate is 93 percent (i.e., making any savings deposit); in general, formal savings is a small percentage of total savings. Perhaps unsurprisingly then, we do not find support for downstream effects, including household consumption and labor earnings[25]. However, our December 2011 survey does reveal that despite this low use of formal savings, subjects have a strong preference for bank savings; subjects overwhelmingly responded that banks were the most secure methods for savings (82 percent), and was the easiest method for savings (48 percent) followed by cash in hand (42 percent). This suggests that even though the intervention did not yield an increase in total savings deposited, the shift towards the formal sector may have important welfare benefits to the individual that are not captured in outcomes such as household consumption.

3.4 Sensitivity to Price

Table 3 tests for differences in savings behavior as a function of the fees levied on the service. We run regressions equivalent to Equations (1) and (2), but replacing the dummy for treatment with the inverse hyperbolic sine of the fee charged that individual to deposit. We limit our observations to those offered the service and surveyed annually, meaning that we compare across randomized fee amounts only among those offered the treatment.[26] Because the fee variable contain zeros, we use its inverse hyperbolic sine (as with the continuous outcomes) to preserve the elasticity (log-log) interpretation. In addition to the saving outcomes reported in earlier tables, we also include *Mobile Savings*, the amount deposited through the mobile platform, and *Mobile Proportion*, the ratio of saving deposits observed through the mobile platform to the total saving deposits reported to the partner bank.[27] We continue to use the inverse hyperbolic sine transformation for both the fee and the savings deposits to provide an elasticity interpretation to γ_1.

We observe a price elasticity that is not statistically different from zero.[28] For differences in amounts (i.e., without using the inverse hyperbolic sine transformation), we do not observe any statistically significant differences in monthly deposits in the partner bank (even when limited to just mobile deposits), in formal

[25]Household consumption is a measure of total monthly expenditure by the household, and labor earnings is total monthly income earned from economic activity.

[26]Unlike the previous analysis that used high frequency (primarily monthly) survey data, these estimations have two observations for the baseline period (i.e., prior to the offer letters) and two observations after the mobile deposit service was introduced (i.e., after the offer letters).

[27]For those who do not report any deposits to the partner bank, we record *Mobile Proportion* as zero. Assuming that the fee deterred use of the partner bank, this will bias our estimates in favor of finding a significant price elasticity for the service.

[28]Online Appendix Table A.5 confirms no consistent or meaningful percentage differences in savings deposits with the partner bank, bank savings deposits, or total savings deposits as a function of the percentage point increase in the fee, and Online Appendix Table A.6 finds these results are robust to the use of probability weights based on the predicted likelihood of being in the panel sample as a function of baseline characteristics, confirming that our results are unlikely to be driven by differential attrition.

Table 3: Price Sensitivity to Fees Offered

	(1) Mobile savings	(2) Mobile proportion	(3) Partner savings	(4) 1[Formal deposit]	(5) Formal savings	(6) 1[Any deposit]	(7) Total savings
	Panel A: Post period (December 2011 - November 2013)						
Fee (IHS)	-0.0196	-0.000630	-0.0124	-0.000604	-0.0435	-0.00505	-0.0978
	(0.223)	(0.768)	(0.845)	(0.954)	(0.635)	(0.400)	(0.110)
Observations (Ind)	1104	1104	1104	1104	1104	1104	1104
	Panel B: All months with individual fixed effects						
Fee (IHS) *Post				0.00725	0.0396	0.000400	-0.0558
				(0.556)	(0.707)	(0.966)	(0.509)
Observations (Ind-month)				4317	4317	4317	4317
Free Treatment Mean	.19	.01	1.18	.27	2.35	.94	8.26

Estimation conducted on the annual sample within which mobile transfer fees were randomized. Saving variables and fees are analyzed using Inverse Hyperbolic Sine, so the interpretation is as an elasticity (percent impacts). Mobile proportion is recorded as 0 for those who did not deposit any partner savings. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross-sectional comparison of treated and control outcomes using all annual post-treatment survey waves. Panel B uses the full set of annual surveys, including individual and survey wave fixed effects, and uses inverse propensity weights for attrition across rounds to make the results representative of the overall panel sample. Free Treatment Mean is the mean of the individuals' mean of those in the annual sample who received the deposit-service for free across post-treatment survey waves. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

savings, or in total savings (see Appendix Table A.7).

Combined with the increases we observed in Table 2, this suggests that the mobile-deposit offer resulted in increased savings with the partner bank and formal saving deposits regardless of the price charged. The lack of price sensitivity we observe is largely driven by the low fees; at 2 and 4 percent fees we do not observe a consistent decrease in use as the fee increases and differences in using the service are generally not statistically significant. However, we do observe that the total amounts deposited using the mobile channel significantly drops for the group charged 8 percent (126 LKR versus 389 LKR mean deposits in the free group, averaged by individual over the entire observed period, significant at 5 percent), though deposits in the partner bank do not. This suggests that at this higher fee, people were still interested in the bank account at the partner bank, but sidestepped the mobile-deposit service. Coupled with the mobile-deposits being a relatively small percent of total reported deposits at all prices, the results suggest that individuals on average may not be willing to pay for the removal of distance related costs, but that the fees associated with opening the savings account were an important transaction cost that reduced savings with a specific provider.

4 Examining heterogeneity in demand

Given the relatively low average adoption rates and moderate impacts on savings, we explore whether baseline characteristics predicted demand and improved targeting would have yielded greater impact on savings. Table 4 explores a number of theoretically motivated baseline characteristics on demand for the service. In addition to the covariates displayed in Table 4, we additionally include the frequency of being surveyed and treatment status as additional controls. We limit the sample to those who were successfully delivered the offer letter, to ensure that the results are driven by demand for the service rather than an inability to offer the service. These covariates were not pre-specified, and are instead motivated by our review of the theoretical literature and our own priors as reflected in the sampling design. We therefore consider these correlations to be exploratory in providing potential direction in targeting subgroups who may have higher demand and greater marginal benefits from mobile-linked financial services.

In general, we find women, those living at intermediate distances from formal banks, and those owning a mobile phone at baseline were significantly more likely to use the service. This suggests that those who experienced a reduction in transit costs (e.g., women, who save smaller amounts more frequently relative to men, and those living further from the bank), and those already familiar with the technology's interface, were most likely to use the service. But we fail to find support for other characteristics predicting demand, including those supported by our sampling hypothesis (e.g., a reported willingness to pay for the service) or theoretically motivated: phone capacity (reduced effort costs), present-biasedness (asymmetric costs for depositing versus withdrawing), bank familiarity (trust related information asymmetry), baseline savings

Table 4: Determinants of Takeup of the Mobile Deposit Service

	(1) Accepted account	(2) Demonstration completed	(3) Used service	(4) Amount deposited, IHS	(5) Amount deposited, LKR	(6) Deposited in Partner Bank, self-reported
Female	0.0375**	0.0910***	0.0756**	0.405**	-29.38	0.00428
	(0.0172)	(0.0266)	(0.0302)	(0.191)	(141.7)	(0.0302)
Married	0.0264	0.0690**	-0.0330	-0.207	-253.6	0.0331
	(0.0213)	(0.0333)	(0.0336)	(0.218)	(304.9)	(0.0336)
Owns mobile phone	0.0108	0.0493	0.0733**	0.537**	186.1*	0.0413
	(0.0261)	(0.0401)	(0.0360)	(0.220)	(110.5)	(0.0367)
Phone savvy	0.00498	0.00301	0.000276	-0.00479	6.311	0.00622
	(0.00335)	(0.00477)	(0.00444)	(0.0284)	(24.87)	(0.00475)
2 to 5 km from bank	0.0105	0.0559**	0.0948***	0.647***	294.1**	0.0812***
	(0.0153)	(0.0232)	(0.0244)	(0.157)	(140.5)	(0.0247)
More than 5km from bank	-0.00166	-0.0393	-0.0383	-0.177	67.25	0.0511
	(0.0207)	(0.0328)	(0.0284)	(0.184)	(141.7)	(0.0329)
Bank experience	0.0173**	0.000241	-0.00845	-0.00717	98.40*	0.0133
	(0.00723)	(0.0108)	(0.0107)	(0.0696)	(57.85)	(0.0112)
Present-biased	0.0301**	0.00584	-0.0231	-0.150	-27.12	-0.0175
	(0.0153)	(0.0242)	(0.0238)	(0.152)	(120.7)	(0.0253)
Discount rate	-0.0590	-0.0362	0.0809	0.772	518.5	0.0176
	(0.0683)	(0.0973)	(0.103)	(0.682)	(530.0)	(0.105)
Willingness to take risks	-0.00120	-0.00413	-0.00817**	-0.0521**	-2.704	-0.00956**
	(0.00268)	(0.00401)	(0.00410)	(0.0260)	(12.14)	(0.00420)
Total savings	-0.00104	0.00122	0.00306	0.0136	-16.24	0.00504
	(0.00193)	(0.00311)	(0.00297)	(0.0190)	(21.23)	(0.00316)
Household consumption	-0.0422***	-0.0571***	0.000489	-0.00992	-109.5	0.0122
	(0.0149)	(0.0208)	(0.0195)	(0.124)	(148.2)	(0.0204)
Willingness to Pay	0.00225	0.00355	-0.00172	-0.00236	38.71	0.00427
	(0.00173)	(0.00275)	(0.00319)	(0.0221)	(28.77)	(0.00337)
Constant	-0.0312	0.0111	0.0190	0.121	123.1	0.0367
	(0.0211)	(0.0273)	(0.0295)	(0.193)	(194.5)	(0.0312)
Observations	1504	1504	1504	1504	1504	1498

Account Accepted is based on enumerator reports. Demonstration completed, Used service, Total Amount Deposited are based on institutional data provided by the partner bank. Deposited in Partner Bank is an indicator of whether the respondent self-reported depositing savings to the partner bank in the previous month on one of the two annual surveys conducted after the roll out of the mobile-deposit service. IHS refers to amounts transformed using the inverse hyperbolic sine function. Demonstration completed indicates that the individual is observed in the partner bank's dataset as having used the service. Regressions pool monthly and annual samples. Regressions are conditional upon the letter being delivered and being in the Panel Sample, include treatment status and frequency of being surveyed as additional covariates, and use robust standard errors.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

(higher value for the service).[29,30]

Those living 2 to 5 km from a bank branch are 11 percentage points more likely to try the service and deposited 70 percent more through the service. This suggests that those living closer may not value the reduction in distance costs as much, and that this benefit tapers off at greater distances, perhaps due to costs of withdrawals. We additionally find that measures of time requirements for banking services are also correlated with higher adoption rates (not shown). This highlights that a primary mechanism for usage is through reducing distance related transaction costs.

Among women, we observe an 8 percentage point greater likelihood of trying the service, and a 40 percent increase in the amount deposited through the mobile-deposit service relative to men. The lack of a difference in total amounts is due to the non-normal distribution of savings deposits and is consistent with gender patterns at baseline – women are more likely than men to save some amount, but conditional on saving, men save larger amounts. This baseline difference suggests women may indeed value the service more as they are smaller and more frequent savers, with arguably higher mobility costs and other-control concerns.

Finally, for those who already owned a mobile phone at baseline, they were no more likely to go through the steps of learning the service, but were more likely to use the service (7 percentage points) and deposited 58 percent more through the service, for an increased amount of 190 LKR (1.73 USD. This suggests that despite the simplicity of the product, the learning costs were high for those who were not previously exposed to the underlying technology.

Given the significant number of non-adopters and evidence of a distributional shift even in the absence of large difference in means, we explore whether targeting the intervention among women and those living at intermediate distances would have been more effective. We do this by expanding Eq (1) and Eq (2) to be a difference-in-difference, Eq (3), and a triple-difference, Eq (4), with respect to the baseline characteristic of interest:

$$SavingsDeposits_{si} = \beta_0 + \beta_1 MobileOfferFree_{si} + \beta_2 Target_{si} + \beta_3 MobileOfferFree * Target_{si} + \mu_s + \epsilon_s i \tag{3}$$

$$SavingsDeposits_{sit} = \beta_0 + \beta_1 MobileOfferFree * Post_{sit} + \beta_2 Target * Post_{sit} + \beta_3 MobileOfferFree * Target \; Post_{sit} + w_t + \alpha_i + \epsilon_{sit} \tag{4}$$

where *Target* is the characteristic of interest. β_3 signifies the additional marginal effect of the intervention of belonging to the subgroup of interest relative to the average effect of those not belonging (β_1). Our primary

[29] We see similar patterns in demand if we replace the indicator for living 2km to 5km from the bank with self-reported time to bank, with the only difference being no significant increase in the amount deposited when measured in LKR. We prefer to use the indicator variable for bank distance, rather than a continuous variable, to allow for graphical representations of the distribution conditional on distance. These distance ranges (under 2km, 2 to 5 km, and over 5km) were defined prior to the intervention and were used to stratify the original listing for the study's sample.

[30] Though we do not observe present-biasedness as being correlated with demand for the service, we still explore heterogeneous effects given the strong theoretical foundation of commitment devices and present-biasedness in saving decision. In general, we do not find support for heterogeneous returns to the present bias. These results are presented in an online appendix.

hypothesis of interest is $H_0 : \beta_1 + \beta_3 = 0$, testing for the total effect of the intervention on the potentially targeted sub-group.[31]

Table 5, Column 1 finds that the increase in savings being deposited into the partner bank is significantly higher among women offered the mobile-deposit service. The mean increase found among women is twice as large as that of treated men. Though not statistically different from men, we do observe that women offered the free mobile-deposit service are more likely to make a monthly deposit into formal savings (6 percentage point increase), and have higher formal savings (55 percent). Additionally, we observe a marginally significant increase in total savings of 23 percent among women. This suggests that women, relative to men, were less likely to substitute saving deposits to the partner bank and formal savings deposits from alternative saving sources. In fact, the negative point estimate suggests a potential of men substituting at a rate greater than 1 to 1 such that there is a net decline in total savings when offered the mobile-deposit service. Overall, our results suggest that the mobile-deposit service was useful to women, who on average save small amounts more frequently.

Similarly, among those at the intermediate distance (2km to 5km from a bank), we observe higher partner bank and formal savings deposits, with some potential for a corresponding increase in total savings. Table 6 finds increased deposits to the partner bank (79 percent) and in formal deposits (26 percent) among those living in the intermediate distance range. Though Panel A finds an increase in total savings, this is less robust when controlling for savings deposited in the period prior to the intervention. Our results by distance suggests that though substitution from formal savings may be comparatively less compared to those living closer and further, it is still the case that the increased deposits in the partner bank is being sourced from alternative savings resulting in a lack of transformative increased savings.

These differences by gender and distance are echoed in our measures for changes in the distribution of savings.[32] However, similar to the total sample, when estimating impact on deposit *amounts*, as opposed to percent changes, results generally remain statistically insignificant. For both females and those living at intermediate distances, the increased partner savings suggests the first month alone is enough to cover the initial subsidy for opening the bank account (502 LKR and 703 LKR[33], respectively). For females, we see a statistically insignificant gain in formal savings (1,025 LKR) and an increase in total savings (3,114 LKR) that is statistically significant. In contrast, for those living at intermediate distances, we see a statistically

[31] We do not show heterogeneity by those who owned a mobile phone at baseline, as this is a significant portion of the sample and is unlikely to be a characteristic that would be used for targeting to improve financial inclusion.

[32] Appendix Figure 1a and 2a depicts the CDF of savings in the partner bank and changes in formal and total savings by gender and intermediate distance, respectively. They show an increase to the partner bank in both the extensive and intensive margin. This effect is corroborated by a KS statistic of .375 and .32 and the SP statistic of .46 and .413, respectively, all of which are statistically significant with $p - value < .001$. Appendix Figure 1b further illustrates the increased savings in formal banking more generally by women, with a KS statistic of .237 ($p - value = .028$), and *SP Statistic* of .58 ($p - value = .115$). Appendix Figure 1c finds no apparent difference in the distribution of total savings by gender, though for the most part, those with the mobile-deposit offer are either to the right or on par with the control for every ranking; the corresponding KS statistic is .118 ($p - value = .664$) and SP statistic is .52 ($p - value$.44). Appendix Figure 2b and 2c show less convincing evidence of an increase in formal savings or total savings by distance, however. By distance, for formal savings we estimate a KS statistic of .142 ($p - value = .08$) and SP statistic of .55 ($p - value = .166$); for total savings, a KS of .118 ($p - value = .206$) and SP of .497 ($p - value = .561$).

[33] This marginal difference is statistically significant at the one percent level.

Table 5: Differential Impacts, by Gender

	(1) Partner savings	(2) 1[Formal deposit]	(3) Formal savings	(4) 1[Any deposit]	(5) Total savings
	Panel A: Post period (December 2011 - November 2013)				
Free Mobile Deposit Offer (β_1)	0.352***	0.0182	0.0715	-0.00928	-0.104
	(0.0859)	(0.0157)	(0.151)	(0.00854)	(0.108)
Free Mobile Deposit Offer * Female (β_3)	0.482**	0.0465	0.387	0.0225	0.411*
	(0.194)	(0.0397)	(0.339)	(0.0189)	(0.227)
Observations (Ind)	790	803	803	803	803
$\beta_1 + \beta_3$	0.831***	.0695*	0.4867	0.0121	0.272
Prob > F-statistic	0.00	0.0754	0.1295	0.4323	0.1212
	Panel B: All months with individual fixed effects				
Free Mobile Deposit Offer * Post (β_1)		0.0316***	0.211**	-0.00955	-0.102
		(0.0114)	(0.100)	(0.00927)	(0.0816)
Free Mobile Deposit Offer * Post * Female (β_3)		0.0293	0.308	0.0194	0.347**
		(0.0279)	(0.231)	(0.0186)	(0.164)
Observations (Ind-month)		20028	20028	20028	20028
$\beta_1 + \beta_3$		0.0642**	0.552**	0.0087	0.233*
Prob > F-statistic		0.0166	0.0112	.5417	0.0841
KS Statistic	.375	.15	.237	.078	.118
p-value	.000	.30	.028	.97	.664
SP Statistic	.46	.498	.58	.382	.52
p-value	.005	.279	.115	.542	.440

Female is an indicator for the subject being female. Estimations are conducted on the monthly panel sample. Savings variables are analyzed using the Inverse Hyperbolic Sine, so the interpretation is as a log (percent impact). Outcomes are monthly flows over the month prior to the survey wave, and the unit of observation is individual in Panel A and individual-month in Panel B. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross sectional comparison of treatment and control outcomes using all post-treatment survey waves. Panel B uses the full set of monthly surveys, includes individual and survey wave fixed effects, and uses inverse propensity weights for attrition across survey waves to retain representation of the overall panel sample. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Differential Impacts, by Distance to the Bank

	(1) Partner savings	(2) 1[Formal deposit]	(3) Formal savings	(4) 1[Any deposit]	(5) Total savings
	Panel A: Post period (December 2011 - November 2013)				
Free Mobile	0.208*	0.00371	-0.0790	-0.0301***	-0.223
Deposit Offer (β_1)	(0.117)	(0.0222)	(0.205)	(0.0115)	(0.147)
Free Mobile Deposit	0.577***	0.0528	0.512*	0.0546***	0.514**
Offer * Intermediate Distance (β_3)	(0.168)	(0.0326)	(0.303)	(0.0165)	(0.209)
Free Mobile Deposit	0.0762	0.00588	0.0801	0.0237	0.0418
Offer * Far Distance	(0.213)	(0.0393)	(0.358)	(0.0213)	(0.262)
Observations (Ind)	790	803	803	803	803
$\beta_1 + \beta_3$	0.785***	.0565**	0.433*	.0245**	0.291**
Prob > F-statistic	0.00	0.0176	0.0527	0.0363	0.0499
	Panel B: All months with individual fixed effects				
Free Mobile Deposit		0.0348**	0.290**	-0.0157	-0.0934
Offer * Post (β_1)		(0.0157)	(0.136)	(0.0120)	(0.106)
Free Mobile Deposit Offer		0.00255	-0.0305	0.0331*	0.266*
*Post * Intermediate Distance (β_3)		(0.0229)	(0.200)	(0.0177)	(0.157)
Free Mobile Deposit Offer		0.0160	0.0521	-0.00613	-0.167
*Post * Far Distance		(0.0304)	(0.260)	(0.0236)	(0.204)
Observations (Ind-month)		20028	20028	20028	20028
$\beta_1 + \beta_3$		0.0373**	0.2595*	0.0174	0.1726
Prob > F-statistic		0.0259	0.0759	0.1818	0.1139
KS Statistic	.320	.172	.142	.074	.118
p-value	.000	.018	.080	.748	.206
SP Statistic	.413	.529	.55	.458	.497
p-value	.006	.103	.166	.230	.561

Intermediate distance refers to households 2-5 km from the nearest bank, Far Distance refers to households located greater than 5 km from the nearest bank. Estimations are conducted on the monthly panel sample. Savings variables are analyzed using the Inverse Hyperbolic Sine, so the interpretation is as a log (percent impact). Outcomes are monthly flows over the month prior to the survey wave, and the unit of observation is individual in Panel A and individual-month in Panel B. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross sectional comparison of treatment and control outcomes using all post-treatment survey waves. Panel B uses the full set of monthly surveys, includes individual and survey wave fixed effects, and uses inverse propensity weights for attrition across survey waves to retain representation of the overall panel sample. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

insignificant reduction in formal savings (1,575 LKR) and increase in total savings (1,167 LKR)[34].

5 Conclusion

Our experiment is one of the first to examine the potential for using mobile phone-linked bank accounts to encourage savings. We find that the introduction of a mobile-deposit service with zero transaction fees significantly increased the share of savings deposited with the partner institution and in the formal banking sector more generally. However, we observe no increase in total household savings or in downstream welfare measures, such as household consumption or labor earnings. Moreover, while the effect on partner bank deposits is proportionally large, the increases were driven by small savers and hence we do not find statistically significant gains in the average level of deposits, suggesting a lack of meaningful increases in deposits from the bank's perspective. Several patterns in the data for subsamples suggest that the groups we expected to benefit most from the reduced transaction costs, such as women and those living at intermediate distances from banks, did indeed have had higher demand for and impact from the service.

Overall, we do not find a transformative effect on total savings from providing a mobile-deposit service. This is despite a concentrated effort to reduce barriers to a minimum (e.g., by removing bank account fees and offering demonstrations of the service) and despite the intervention being a combined effect of mobile money and formal saving benefits. Our results suggest limited effects from increasing convenience and reducing transaction costs for savings deposits. This is further supported by the lack of responsiveness to the price of using the service and the large share of deposits made to accounts via traditional channels.

The recent work by Dupas et al. (forthcoming) finds similarly modest effects from increasing bank access by eliminating pecuniary costs for opening bank accounts. Our results suggest it is unlikely that the additional reduction in transaction costs gained from introducing mobile savings will transform saving rates, at least in an environment with relatively well developed and low-cost banking options such as Sri Lanka. This is consistent with studies in contexts more integrated with mobile money that focus on the impact of savings from mobile money or connecting formal accounts to existing mobile-money users (Batista and Vicente, 2017; Bastian et al., 2018; Jack and Suri, 2016; Batista and Vincente, 2016). While it still may be the case that the impact on savings would be greater in places that are more familiar and integrated with mobile money or where banks are more remote, our findings still highlight that a "build it and they will come" solution is not enough for people to internalize the benefits of reduced transaction costs related to formal saving devices.

Our results highlight two potential explanations for why reducing transaction costs for formal deposits may generate modest marginal gains in increasing savings. First, though removing transaction costs is critical for savings efficiency, the marginal gain from reduced transaction costs may be relatively small due

[34]The estimates for saving amounts with the partner bank use the estimating equation in Panel A, and estimates for formal and total savings amount use the estimating equation in Panel B. Estimates for formal and total savings are not meaningfully different between the two estimating equations.

to the presence of easily accessed informal saving methods. This suggests that we should think of the marginal benefits to formal savings products relative to the status quo provided by informal saving devices. This may also explain heterogeneity observed in the savings mobilization literature - perhaps interventions that address behavioral constraints are especially promising as they may not be solved by *either* formal or informal saving methods Further progress in generating financial inclusion by 'banking the unbanked' will depend on improving our understanding of the ways that formal financial services differ from and improve upon informal financial options.

Second, the gains from reducing transaction costs in saving may be mediated by other constraints. Specifically, our paper, along with others on mobile money, focuses on reducing the transaction costs of deposits. There is good reason to do so: deposits are more frequent than withdrawals and such asymmetrical costs may be well-founded given concerns of present-biasedness (i.e., these asymmetrical costs serve as a commitment device). However, this pattern of the frequency of saving deposits relative to withdrawals may instead reflect the high cost of withdrawal that is present in mobile money and many informal devices (e.g., ROSCAs and Seetus). It could be that reduced withdrawal costs are an important transaction costs that inhibit greater use of saving accounts (consistent with the fact that those far from banks are less likely to save using our mobile product than those at intermediate distances). This is a characteristic missing in most saving devices and warrants further research, especially given its natural trade-off with addressing behavioral constraints. In general, our modest results suggest that a better understanding of technology's role in altering substitutability across saving mechanisms is important in understanding the promise and limitations of digital finance.

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A Variable Appendix

Variable Name: Definition

Female: Indicator for responding female to gender.

Married: Indicator for responding married to marital status.

Present-Biased: Suppose someone was going to pay you Rs. 1500, 6 months from now. He/she offers to pay you a lower amount in 5 months time. What amount received in 5 months time would make you just as happy as receiving Rs. 1500 in 6 months time? Indicator for whether reported discount rate in this question is greater than when asked about the present (above question).

Discount Rate: Suppose someone was going to pay you Rs. 1500 1 month from now. He/she offers to pay you a lower amount today. What amount today would make you just as happy as receiving Rs. 1500 in 1 month? The discount rate is equal to $(1500 - response)/1500$.

Willingness to Take Risks: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 0 means:"unwilling to take risks"-a very careful person and the value 10 means: "fully prepared to take risks"- a careless person. Which point describes you the best?

Owns Mobile Phone: Does anyone (including you) living in the household have a cellular phone? Indicator for yes.

Phone Savviness: First component of principle component analysis of the following: How often do you add money to your phone network (indicator for weekly or daily)? What is the approximate distance from your home to the nearest mobile phone topup card/reload agent (Indicator for 200m or less)? What is the assessment of the quality of cellular reception (signals) in the place you live (Indicator for excellent or good)? How often do you use a mobile phone to receive or make calls? How often do you use a mobile phone to send or receive text messages? Have you ever added or changed a SIM card in a phone? How many SIM cards do you have in your current phone? What is your assessment of the quality of cellular reception (signals) in the place you live (On any network)? How often do you add money to your phone network? What is the approximate distance from your home to the nearest mobile phone topup card/reload agent? Assume that you needed to purchase topup card or reload from your mobile phone. How much time would it take for you to go from your home to your agent, complete the transaction, and return back to your home (minutes)? If you had a technical problem with your cell phone, who would you mainly ask for help? How often do you change your ringtone? What are other services that you, yourself, obtain via your mobile phone: Phone camera, Internet access, Phone games, Phone video, listen to phone radio, phone tv, phone mp3/mp4/3gp (songs), phone calculator, phone alarm/reminder, multimedia message services, data exchange services (e.g., Bluetooth), Phone torch, phone dictionary, phone clock, phone calendar, other (specify).

Nearest Bank Btwn 2 and 5 km: Indicator for nearest bank (i.e., distance from the nearest town) between two and five km.

Willingness to Pay: In many countries a fee is charged for the use of this service. So in order to deposit

Rs 100, one might have to incur a fee of about Rs 5-20. Despite the fee, customers are still willing to use this service due to saving in time and cost and the convenience of being able to deposit money at any time. If you were being charged a fee for this service, what is the maximum fee that you would be willing to bear in order to deposit Rs 100? (Missing responses were coded as 0. Results are robust to excluding missing values.) **Bank Experience**: First component of principle component analysis of the following: Trust Banks, Has Bank Account, Used ATM (Yearly Recall).

Has Bank Account: Please tell me about the formal savings product that you use. Do you have an account with this bank or institution: Private bank, government bank, microfinance organizations, development banks, national savings banks, samrudhi bank, sanasa bank, development project such as IDRP/REAP/ABG, Farmers Organization, other (specify).

Trusts Banks: I am going to name a number of organizations. For each one, could you tell me how much confidence you have in them: is it a great deal of confidence, quite a lot of confidence, not very much confidence, or none at all? Banks/Financial Institution. Indicator for "a great deal".

Used ATM (Yearly Recall): How often do you use an ATM card to withdraw money from a bank? Indicator for at least once a year.

Inverse Hyperbolic Sine Transformation:

Mobile savings: The amount deposited into the partner bank through the mobile-deposit service.

Partner Savings: After deducting the total amount of money given to others from the total amount of money received, you had Rs (mention total amount from previous question) remaining for saving or spending in the past month of . Can you tell me how much money you saved using the following methods – Saving in an institution such as a bank? Money saved in [partner bank]?

Formal Savings: After deducting the total amount of money given to others from the total amount of money received, you had Rs (mention total amount from previous question) remaining for saving or spending in the past month of . Can you tell me how much money you saved using the following methods – Saving in an institution such as a bank? After September 2012, this was replaced by the sum of two questions "Money saved in [partner bank]?" and "Money saved in bank accounts in your name at banks other than [partner bank]?"

Total Savings: After deducting the total amount of money given to others from the total amount of money received, you had Rs (mention total amount in previous question) remaining for saving or spending in the past month of . Can you tell me how much money you saved using the following methods – total?

Mobile proportion: The observed amount deposited through the mobile-deposit service divided by the self-reported total amount deposited into the partner bank. **1[Formal Savings]**: Indicator for Formal Savings being greater than 0 in the given month.

1[Any Deposit]: Indicator for Total Savings being greater than 0 in the given month.

Annual Sample: Indicator for subjects surveyed only once per year (as opposed to Monthly Survey Sample).

Letter Delivered: An indicator for whether enumerators reported providing the offer to the subject.

Account Accepted: An indicator for whether enumerators reported the offer was accepted by the subject (e.g., accepted phone).

Demonstration Completed: An indicator for whether enumerators reported completing the demonstration for the subject.

Used Service: An indicator for whether the subject made a deposit through the mobile-deposit service as reported by the partner bank.

Frequent User: An indicator for whether the subject made ten or more deposits through the mobile-deposit service as reported by the partner bank.

Amount Deposited (through mobile deposit service): The total amount deposited by the subject through the mobile deposit service as reported by the partner bank (transformed through the inverse hyperbolic sine transformation, unless otherwise noted).

Deposited in Partner Bank, self-reported: Indicator for whether the subject deposited in the partner bank (Partner Savings > 0) in the given month.

Post: Indicator for December 2011 and onward, after the letters introducing the mobile-deposit service offer were delivered.

B Online Appendix Tables

Table A.1: Summary Means

	Total Sample	Monthly Sample			Annual Sample		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Control	0%	0%	2%	4%	8%
Female	0.192	0.207	0.175	0.186	0.183	0.195	0.209
Married	0.848	0.813	0.851	0.882	0.867	0.894	0.798**
Present-biased	0.302	0.299	0.308	0.317	0.313	0.253	0.322
Discount rate	0.084	0.074**	0.090	0.082	0.089	0.075	0.094
Willingness to take risks	5.573	5.418	5.552	5.688	5.613	5.575	5.671
Owns mobile phone	0.892	0.905	0.890	0.896	0.900	0.873	0.884
Phone savvy	0.003	0.214	0.340	-0.096	-0.161	-0.470	-0.048
2 to 5 km from bank	0.397	0.413	0.361	0.412	0.407	0.401	0.404
More than 5km from bank	0.165	0.163	0.184	0.140	0.170	0.147	0.168
Bank experience	0.011	-0.048	0.020	0.106	0.017	0.046	-0.037
Observations (Ind)	1908	368	435	221	300	292	292

Variable definitions are provided in Appendix. For any given variable, at most two observations in a given category were missing a response. Sample is conditional on being in the Panel Sample. Comparisons are made to the 0% fee of the same survey frequency: Column 2 is compared to Column 3, and Column 5 to 7 is compared with Column 4. Comparisons across sub-samples include variables upon which the random assignment were stratified and uses robust standard errors. *p<.10, **p<.05, ***p<.01.

Table A.2: Attrition

Dependent Variable:	Panel Sample	Responds to Survey Wave	Panel Sample	Responds to Survey Wave	Panel Sample	Responds to Survey Wave	Panel Sample	Responds to Survey Wave
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Monthly Survey Sample							
Free Mobile Deposit Offer	-0.0124	-0.0138	-0.0116	0.00362	-0.0179	-0.0240	-0.0121	0.00227
	(0.0134)	(0.0117)	(0.0354)	(0.0246)	(0.0231)	(0.0189)	(0.0211)	(0.0217)
Free Mobile Deposit Offer*Post		-0.00373		-0.0183		-0.0133		-0.0130
		(0.0116)		(0.0258)		(0.0188)		(0.0192)
Observations	837	21762	161	4186	325	8450	251	6526
Control Mean	.97	.93	.95	.94	.96	.94	.98	.94
Sample	All	All	Female	Female	Mid-range Distance	Mid-range Distance	Present-Biased	Present-Biased
	Panel B: Annual Survey Sample							
2% Mobile Deposit Offer	-0.0240	-0.00639						
	(0.0164)	(0.00953)						
2% Mobile Deposit Offer*Post		-0.0126						
		(0.0171)						
4% Mobile Deposit Offer	-0.0314*	-0.0167						
	(0.0171)	(0.0102)						
4% Mobile Deposit Offer*Post		-0.0165						
		(0.0179)						
8% Mobile Deposit Offer	-0.0492***	-0.0220**						
	(0.0184)	(0.0106)						
8% Mobile Deposit Offer*Post		-0.0347*						
		(0.0183)						
Observations	1168	4672						
Free Offer Mean	.97	.96						

Panel is an indicator for whether the individual is observed in the panel sample, defined as having at least one survey response in the period after the mobile deposit offer if rolled out (i.e., after the delivery of initial letters). Responded is an indicator for whether the individual responded to the survey in the given month (or year for the annual sample) of the survey and is not conditional upon being observed in the Panel Sample. Panel A is restricted to the monthly surveyed sample and Panel B is restricted to the annually surveyed sample. Post is an indicator variable for survey rounds after the initial offer letters for the service were delivered (i.e., December 2011 and onward). Mid-range distance refers to whether the individual lived two to five km from the closest bank. Regressions include variables upon which the random assignment were stratified. Robust standard errors are used in regressions with Panel as the dependent variable, and standard errors are clustered at the individual level in regressions with Responded as the dependent variable. *p<.10, **p<.05, ***p<.01.

Table A.3: Pre-Treatment Balance

	(1) 1[Formal deposit]	(2) Formal savings	(3) 1[Any deposit]	(4) Total savings
	Panel A: All Subjects Surveyed Monthly			
Free Mobile Deposit Offer	-0.0138	-0.161	-0.00113	-0.00807
	(0.0152)	(0.134)	(0.0111)	(0.119)
Observations	7787	7787	7787	7787
	Panel B: Annual Sample			
2% Fee	0.0272	0.225	0.00494	0.0617
	(0.0255)	(0.221)	(0.0233)	(0.214)
4% Fee	-0.0144	-0.129	-0.0162	-0.110
	(0.0253)	(0.217)	(0.0239)	(0.215)
8% Fee	-0.0206	-0.226	-0.00856	-0.0528
	(0.0252)	(0.215)	(0.0234)	(0.212)
Observations	2168	2168	2168	2168
Control Mean	.21	1.77	.87	7.50

Panel A are estimated on the monthly sample and Panel B is estimated on the annual sample. All regressions use the panel sample, defined as having at least one observation in the post-treatment. Outcomes are monthly flows over the month prior to the survey wave, and the unit of observation is the individual month. Savings variables are analyzed using the Inverse Hyperbolic Sine, so the interpretation is as a log (percent impacts). Control Mean are the mean of all individual-monthly flows in the pre-intervention period for those in the control. All regressions control for the stratification variables used in the randomization protocol and cluster the standard errors at the individual level. *p<.10, **p<.05, ***p<.01.

Table A.4: Effect of Free Mobile Deposit Offer, LKR

	(1) Partner savings	(2) Formal savings	(3) Total savings
	Panel A: Post period (December 2011 - November 2013)		
Free Mobile Deposit Offer	95.14	-801.4	-1533.7
Deposit Offer	(107.1)	(903.6)	(1571.8)
Observations (Ind)	790	803	803
	Panel B: All months with individual fixed effects		
Free Mobile		788.3	9784.1
Deposit Offer * Post		(631.5)	(7445.4)
Observations (Ind-month)		20028	20028
Control Mean	281	2,832	8,733

Estimations are conducted on the monthly panel sample. Savings variables are in LKR . Outcomes are monthly flows over the month prior to the survey wave, and the unit of observation is individual in Panel A and individual month in Panel B. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross sectional comparison of treatment and control outcomes using all post-treatment survey waves. Panel B uses the full set of monthly surveys, includes individual and survey wave fixed effects, and uses inverse propensity weights for attrition across survey waves to make the results representative of the overall panel sample. The Control Mean is all the mean of control individuals' mean across post-treatment survey waves for the given outcome variable. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5: Price Sensitivity by Percentage Point Increase in Fee

	(1) Mobile savings	(2) Mobile proportion	(3) Partner savings	(4) 1[Formal deposit]	(5) Formal savings	(6) 1[Any deposit]	(7) Total savings
	Panel A: Post period (December 2011 - November 2013)						
Fee	-0.00839	-0.000388	0.00945	0.00332	0.0150	-0.00228	-0.0301
	(0.106)	(0.528)	(0.661)	(0.346)	(0.620)	(0.272)	(0.147)
Observations (Ind)	1104	1104	1104	1104	1104	1104	1104
	Panel B: All months with individual fixed effects						
Fee *Post				0.00707*	0.0536	-0.000554	-0.0162
				(0.086)	(0.123)	(0.863)	(0.571)
Observations (Ind-month)				4317	4317	4317	4317

Estimation conducted on the annual sample within which mobile transfer fees were randomized. Saving variables are analyzed using Inverse Hyperbolic Sine, so the interpretation the impact of a percentage increase in the fee on the percent impact on savings. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross-sectional comparison of treated and control outcomes using all annual post-treatment survey waves. Panel B uses the full set of annual surveys, including individual and survey wave fixed effects, and uses inverse propensity weights for attrition across rounds to make the results representative of the overall panel sample. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.6: Price Sensitivity Weighted by Survey Non-response

	(1) Mobile savings	(2) Mobile proportion	(3) Partner savings	(4) 1[Formal deposit]	(5) Formal savings	(6) 1[Any deposit]	(7) Total savings
	Panel A: Post period (December 2011 - November 2013)						
IHS Fee	-0.0199	-0.000691	-0.0171	-0.00102	-0.0440	-0.00544	-0.100
	(0.216)	(0.751)	(0.790)	(0.923)	(0.635)	(0.362)	(0.101)
Observations (Ind)	1100	1100	1100	1100	1100	1100	1100
	Panel B: All months with individual fixed effects						
IHS Fee*Post				0.00730	0.0429	-0.000491	-0.0644
				(0.554)	(0.683)	(0.958)	(0.442)
Observations (Ind-month)				4301	4301	4301	4301

Estimation conducted on the annual sample within which mobile transfer fees were randomized. Saving variables and fees are analyzed using Inverse Hyperbolic Sine, so the interpretation is as an elasticity (percent impacts). All regressions control for the stratification variables used in the randomization protocol, use robust standard errors, and weight observations based on predicted likelihood of being observed in the Panel Sample as a function of baseline characteristics. Panel A conducts a cross-sectional comparison of treated and control outcomes using all annual post-treatment survey waves. Panel B uses the full set of annual surveys, including individual and survey wave fixed effects. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Price Sensitivity by Percentage Point Increase in Fee, LKR

	(1) Mobile savings	(2) Partner savings	(3) Formal savings	(4) Total savings
	Panel A: Post period (December 2011 - November 2013)			
Fee	-1.676*	16.56	-262.2*	-368.6*
	(0.060)	(0.683)	(0.079)	(0.064)
Observations (Ind)	1104	1104	1104	1104
	Panel B: All months with individual fixed effects			
Fee *Post			-166.4	-263.2
			(0.211)	(0.130)
Observations (Ind-month)			4317	4317
Free Treatment Mean	21	578	4,200	9,338

Estimation conducted on the annual sample within which mobile transfer fees were randomized. Saving variables are in LKR and fees are in percent charged. Mobile proportion is recorded as 0 for those who did not deposit any partner savings. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross-sectional comparison of treated and control outcomes using all annual post-treatment survey waves. Panel B uses the full set of annual surveys, including individual and survey wave fixed effects, and uses inverse propensity weights for attrition across rounds to make the results representative of the overall panel sample. Free Treatment Mean is the mean of the mean of those in the annual sample who received the deposit-service for free across post-treatment survey waves. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

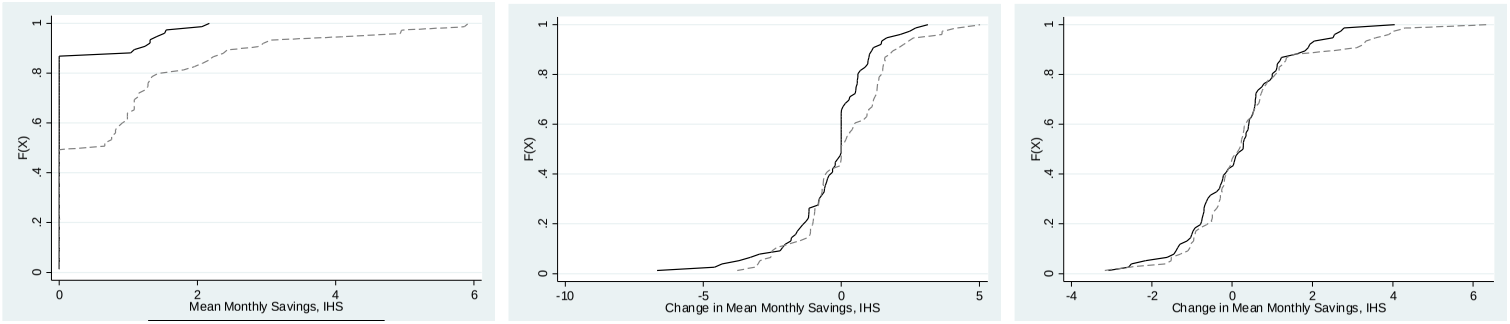
Table A.8: Differential Impacts, by Present Bias

	(1) Mobile savings	(2) Mobile proportion	(3) Partner savings	(4) 1[Formal deposit]	(5) Formal savings	(6) 1[Any deposit]	(7) Total savings
	Panel A: Post period (December 2011 - November 2013)						
Free Mobile	0.254***	0.0170***	0.455***	0.0105	-0.0224	-0.00621	-0.0637
Deposit Offer (β_1)	(0.0358)	(0.00487)	(0.0898)	(0.0174)	(0.162)	(0.00868)	(0.110)
Free Mobile	-0.0448	-0.00265	-0.0412	0.0477	0.509*	0.00274	0.127
Deposit Offer * Present-biased (β_3)	(0.0601)	(0.00718)	(0.169)	(0.0319)	(0.295)	(0.0172)	(0.215)
Observations (Ind)	803	790	790	803	803	803	803
$\beta_1 + \beta_3$	0.209***	0.014***	0.4151***	.0564**	0.4565*	-0.00515	0.0279
Prob > F-statistic	0.00	0.007	0.0038	0.0284	0.0483	0.8165	0.7313
	Panel B: All months with individual fixed effects						
Free Mobile Deposit				0.0239*	0.137	-0.00378	-0.0329
Offer * Post (β_1)				(0.0124)	(0.108)	(0.00980)	(0.0860)
Free Mobile Deposit				0.0479**	0.496**	-0.00452	0.0147
Offer *Post * Present-biased (β_3)				(0.0228)	(0.198)	(0.0174)	(0.154)
Observations (Ind-month)				20028	20028	20028	20028
$\beta_1 + \beta_3$				.0736***	.648***	-0.0109	-0.0425
Prob > F-statistic				0.0002	0.0001	.5646	.8865
KS Statistic	.231	.083	.229	.120	.219	.076	.075
p-value	.002	.759	.003	.318	.005	.843	.85
SP Statistic	.232	.079	.36	.532	.597	.381	.499
p-value	.004	.124	.013	.050	.03	.694	.122

Estimations are conducted on the monthly panel sample. Savings variables are analyzed using the Inverse Hyperbolic Sine, so the interpretation is as a log (percent impact). Outcomes are monthly flows over the month prior to the survey wave, and the unit of observation is individual in Panel A and individual month in Panel B. All regressions control for the stratification variables used in the randomization protocol and use robust standard errors. Panel A conducts a cross sectional comparison of treatment and control outcomes using all post-treatment survey waves. Panel B uses the full set of monthly surveys, includes individual and survey wave fixed effects, and uses inverse propensity weights for attrition across survey waves to make the results representative of the overall panel sample. Mobile deposits are observed in the institutional data, Mobile proportion is Mobile Deposits (Column 1) relative to total deposits with the partner bank (Column 3), and the remaining outcomes are self reported in survey data. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

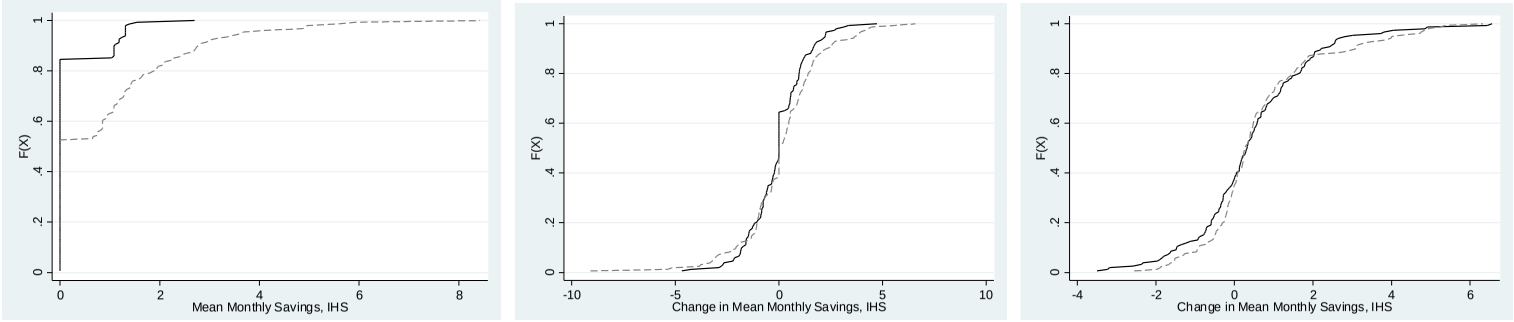
Appendix Figure 1: Females

(a) Left: Mean Monthly Partner Bank Deposits; (b) Center: Change in Mean Monthly Formal Deposits; (c) Right: Change in Mean Monthly Total Deposits



Appendix Figure 2: Intermediate Distance, 2 to 5 km from nearest bank

(a) Left: Mean Monthly Partner Bank Deposits; (b) Center: Change in Mean Monthly Formal Deposits; (c) Right: Change in Mean Monthly Total Deposits



Appendix Figure 3: Present-Biased

(a) Left: Mean Monthly Partner Bank Deposits; (b) Center: Change in Mean Monthly Formal Deposits; (c) Right: Change in Mean Monthly Total Deposits